

Mid-Infrared Lasers

Completed Technology Project (2013 - 2014)



Project Introduction

Mid infrared solid state lasers for Differential Absorption Lidar (DIAL) systems required for understanding atmospheric chemistry are not available. This program will use 2 methods for circumventing the nonradiative quenching effect to enable such systems.

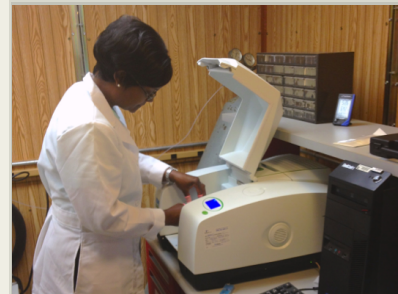
Mid Infrared DIAL systems can provide vital data needed by atmospheric scientists to understand atmospheric chemistry. The Decadal Survey recommended missions, such as ASCENDS and GACM, to measure atmospheric constituents such as CO₂, CH₄, CO, O₃, NO₂, SO₂, and CH₂O. However, as noted by the Decadal Survey, mid infrared solid state lasers needed for DIAL systems are not available. This program proposes a systematic search for novel mid infrared solid state lasers utilizing a quantum mechanical model and verifying results using spectroscopy. Specifically novel mid infrared lasers will be sought to measure the atmospheric constituents noted above. A 2 front approach is proposed. On 1 front, Langley's quantum mechanical model will be used, where applicable, to predict good laser materials. On the other front, mid infrared spectrometers will measure both absorption and fluorescence spectra will to be analyzed. This information will verify the quantum mechanical model predictions and serve as input parameters for laser models. A successful program ends with the identification of a good laser material for at least 1 of the listed atmospheric constituents and a measurement of its germane spectroscopic parameters. The eventual goal is the demonstration of a mid infrared laser suitable for remote sensing work.

Anticipated Benefits

Missions that are already funded generally have their own well-developed objectives and approach to the technology development. MIR lasers are a new avenue of exploration, so I am not aware of any funded mission seeking MIR technology specifically, but they could certainly be potentially enabling to funded missions seeking to make use of or expand into the MIR.

The Decadal Survey recommended missions, such as ASCENDS and GACM, to measure atmospheric constituents, but has stated that there is presently no suitable laser for GACM. An anticipated benefit of this program is to invent the requisite lasers that may be useful for such a mission.

Mid Infrared Lasers cover a wide territory operating 3-12 micrometers, and as such the study of MIR lasers could enable commercial and Space Industry technologies that have interest in this wavelength range.



Project Image Mid-Infrared Lasers

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Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

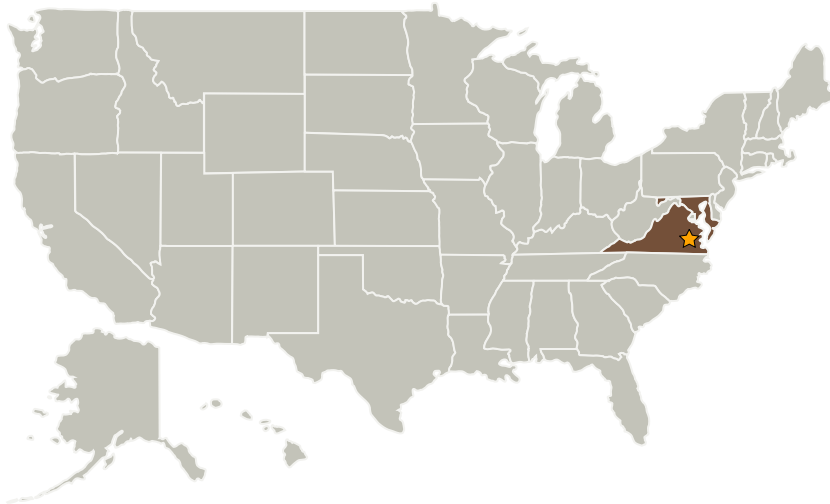
Center Independent Research & Development: LaRC IRAD

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia

Co-Funding Partners	Type	Location
Brimrose Technology Corporation(BTC)	Industry	Sparks, Maryland
Hampton University	Academia	Hampton, Virginia
Lockheed Martin Space Systems(LMSS)	Industry	Sunnyvale, California

Primary U.S. Work Locations	
Maryland	Virginia

Project Management

Program Manager:

Julie A Williams-byrd

Project Manager:

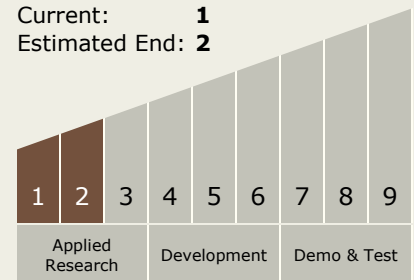
Brian M Walsh

Principal Investigator:

Brian M Walsh

Technology Maturity (TRL)

Start: **1**
 Current: **1**
 Estimated End: **2**



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - TX08.1 Remote Sensing Instruments/Sensors
 - TX08.1.5 Lasers

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Images



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Project Image Mid-Infrared Lasers
(<https://techport.nasa.gov/image/2295>)